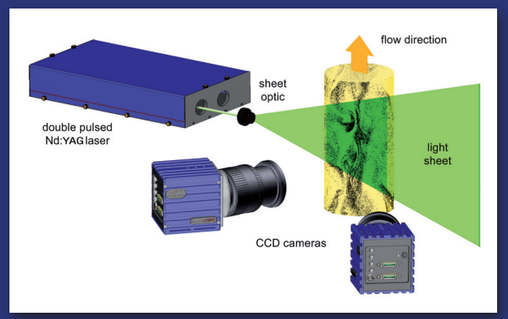
LaVision

FOCUS ON IMAGING

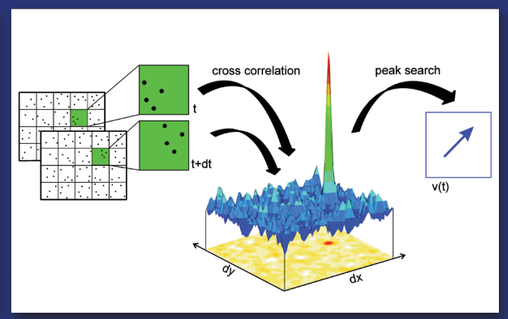
Particle Image Velocimetry

PIV is a non intrusive measurement technique used to obtain instantaneous velocity fields in a two dimensional region of gas or liquid flows.



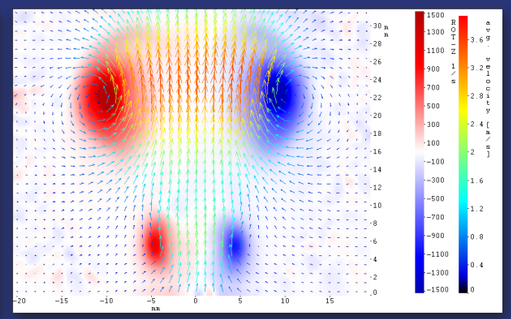
Setup

Light scattering particles are added to the flow. A laser beam is formed into a light sheet illuminating seeding particles twice with a short time interval Δt. The scattered light is recorded onto two consecutive frames of a high resolution digital camera. Microscopic, endoscopic and macroscopic configurations cover a wide range of applications in gaseous and liquid media.



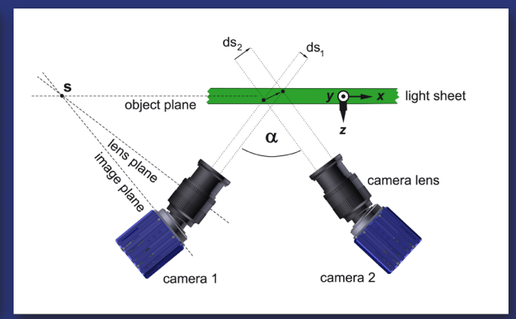
Evaluation

The particle image is subdivided into small interrogation windows. For each interrogation window the average particle image separation (Δx, Δy) is determined by cross-correlation and localization of the correlation peak. When M is the magnification of the camera the velocity components (u,v) in this interrogation window is given by u=(1/M)(Δx/Δt) and v=(1/M)(Δy/Δt).



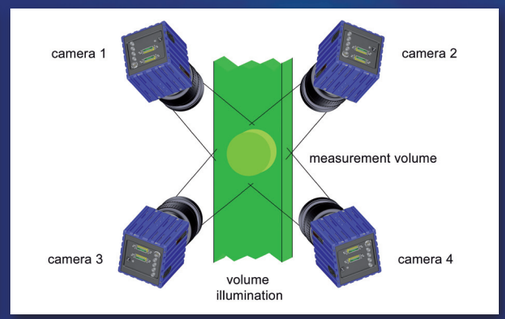
Spatial derivatives

From the velocity field a range of spatial derivatives can be derived such as vorticity, shear stress and turbulent energy. Capturing and computing a sequence of images can provide information about the temporal behavior of the flow.



Stereo PIV

All three velocity components inside a two dimensional field of view can be measured using a second camera and stereoscopic imaging. After image calibration the three components of the velocity vector can be derived from the two displacement projections. Scheimpflug lens arrangements keep all areas of the image plane in focus.



Tomographic PIV

A Tomographic PIV system with typically 2-4 cameras extends the flow measurement into a full volume. Processing is done by tomographic reconstruction of voxel intensities for each time step followed by 3D3C-cross-correlation between interrogation volumes. This allows for instantaneous measurement of all three velocity components in a three dimensional measurement volume (3D3C) visualizing the 3D flow structure.

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